thereby preparing an aqueous solution of manganese sulfate;

purifying the aqueous solution of manganese sulfate; and then

subjecting the purified solution to electrolytic oxidation to oxidize the manganese sulfate.

33. (Amended) A process for producing electrolytic manganese dioxide which comprises:

a9

preparing a treated manganese ore by the process of Claim 7;

adding sulfuric acid to the treated manganese ore to dissolve the ore, thereby preparing an aqueous solution of manganese sulfate;

purifying the aqueous solution of manganese sulfate; and then

subjecting the purified solution to electrolytic oxidation to oxidize the manganese sulfate.

SubB14

REMARKS

Claims 13, 14 and 31 have been canceled. Claims 1-12, 15-30, 32 and 33 and newly added Claim 34 remain active in the case. Reconsideration is respectfully requested.

Applicants' representative wishes to thank Examiner Bos for the helpful and courteous interview of August 22, 2002. As a result of the discussion, it is believed that the issues in the case have been clarified and that the prosecution of the application has been materially advanced.

Claim Rejection, 35 USC 112

The amendments made to the indicated claims are believed largely to be self-explanatory, particularly in light of the comments made by the Examiner on pages 2 and 3 of the outstanding Office Action, and do not warrant any further comment.

With respect to Claim 7, however, applicants have made the claim dependent on Claim 1 which claims the treated manganese ore of the invention and as such the language of lines 2-5

of the original form of the claim is redundant and has been deleted. Further, Claim 7 has been amended by incorporation of the subject matter of Claims 13 and 14 therein. The same comments apply to Claim 10 with further comment that the language of the last step of the two step process has been improved upon and placed in conventional process claim language format.

Claim 9 has been amended by deleting the language objected to in the claim and by inserting an alternate description in the text of the claim which is based on the disclosure of page 21, lines 7 to 10 of the specification. Accordingly, the issue raised is believed obviated.

Claim 11 has been amended to eliminate redundant language in the claim.

Claim 31 has been canceled in favor of new Claim 34. Withdrawal of the non-reference ground of rejection is respectfully requested.

The present invention relates to a treated manganese ore from which manganese sulfate is derived by which electrolytic grade manganese dioxide is prepared. In fact, the objective of the invention is to prepare a treated manganese ore of exceptional purity such that as stated in Claim 1, the treated ore exhibits a degree of manganese dissolution of 98.0 % or higher based on the manganese content of the treated ore. The process by which the treated ore of the invention has the advantages of reducing the amount of slag in the production step and also reduces the potassium content of the ore which is important in preparing a product which can be used to prepare manganese dioxide of high purity for use in electrolytic applications.

As such, the claimed treated ore of the invention exhibits a degree of manganese dissolution of 98.0 % or higher based on the manganese content of the treated ore. Further, as to the process embodiments by which the treated ore is produced, the treated ore results by subjecting an appropriate manganese ore to reduction by contact with a reducing gas which does not contain oxygen, wherein the amount of the reducing gas used is such as to range from 1.0 to 2.0 times the theoretical amount necessary to reduce the manganese ore. (See Claim 7) A further

embodiment of the process is that following the reduction treatment of the ore, the reduced ore is immersed in water having a temperature of 70° C to the boiling point at atmospheric pressure as embodied in Claim 10.

The effectiveness of the process embodiments of producing the treated manganese ore of the invention is demonstrated by the data in Table 1 of the specification, particularly the potassium contents of embodiments of the invention as indicated by the K/Mn ratios in the table and the degrees of manganese dissolution of embodiments of the invention.

Claims 1-9 and 13-22 stand rejected based on 35 USC 103(a) as obvious over Welsh, U. S. Patent 3,375,097. This ground of rejection is respectfully traversed.

Welsh is of relevance to the present invention insofar as it teaches the reduction of manganese ore to MnO with no requirement for the production of a manganese ore which is able to result in an exceptionally pure manganese oxide product useful in electrolytic applications. There thus is no teaching or suggestion in the patent of a treated manganese ore having the minimum 98.0 wt % dissolvability in sulfuric acid which characterizes the treated manganese ore of the invention. Thus, Claim 1 is not rendered obvious by Welsh.

As to the process embodiment of the invention of Claim 7, although Welsh describes the treatment of manganese ore with a reducing gas which primarily appears to be synthesis gas (CO + H_2), nevertheless, the reducing gas employed must contain some significant amount of oxygen. In this system, reduction results in the formation of Mn_2O_3 as an necessary intermediate in the preparation of MnO. On the other hand, in the present process as claimed in Claim 7, reduction is conducted with a reducing gas which does not contain oxygen, with the result that Mn_2O_3 is not produced as an intermediate, but a product treated ore of high purity and excellent dissolvability is produced. (The Examiner is requested to note that applicants have amended the process claims to recite a reducing atmosphere which does **not** contain oxygen, because **implicit**

support for such is found in the Examples of the invention where hydrogen is diluted with nitrogen to the extent that the two component gas contains 40 % by vol hydrogen. Applicants submit that the description provided in Example 1, page 29, lines 9-11, for example, makes it abundantly clear that the gas prepared and used in the process in no way can be considered to include an atmosphere which contains some significant amount of oxygen, because the atmosphere used is formed from **only** hydrogen and nitrogen. Thus, the appropriate language in Claims 7 and 10 is not believed to constitute new matter to the case.)

It should be further noted that the patent nowhere shows or suggests the description in present Claims 7 and 10 that the amount of reducing gas is limited in a reduction process to an amount of reducing gas of 1.0 to 2.0 times the theoretical amount necessary to fully reduce the manganese in the ore. Accordingly, withdrawal of the rejection is respectfully requested.

Claims 1-30 stand rejected based on 35 USC 103(a) as obvious over El Tawil, U. S. Patent 4,985,216, Sasaki, U.S. Patent 3,667,906, Kane et al, U.S. Patent 3,810,827 or Barner et al, U.S. Patent 4,044,094. This ground of rejection is respectfully traversed.

As indicated by applicants' representative at the interview, the El Tawil patent discloses a process for treating a Mn-Ag ore for the recovery of silver values from the ore. (See, for example, Claim 1 and column 5, lines 40-42) As such therefore, there is no teaching or suggestion in the patent of the treated manganese ore of the present invention which has the characteristic of a degree of manganese dissolution of at least 98.0 wt % in sulfuric acid. Although the patent teaches a process of metal recovery based on a step in which the ore starting material is subjected to a high temperature reduction with a reducing gas, nevertheless, the reducing gas employed specifically is a saturated or unsaturated hydrocarbon gas of a carbon atom content of 2 to 8 carbon atoms. (Column 2, lines 30-30) These reducing gases do not fall within the scope of reducing gases of the presently claimed process embodiments. Moreover,

there is no teaching or suggestion of requiring the use of an amount of reducing gas which ranges in amount of 1.0 to 2.0 times the amount of reducing gas required to reduce the manganese component of the ore. Still further, there is no teaching or suggestion of the water treatment embodiment of the present process to produce a treated manganese ore containing an especially low amount of potassium.

Although the Sasaki patent teaches the preparation of an ore containing a decreased amount of potassium by roasting an ore in the presence of a reducing agent, nevertheless, as described in column 2, lines 35 et seq, the reducing agent employed is a non-gaseous material such as a heavy oil or "carbon material". The reduction process proceeds through a number of intermediate steps in which partially reduced oxides including Mn_2O_3 and Mn_3O_4 are produced. Accordingly, there is no teaching or suggestion in the patent of a reducing atmosphere that contains no oxygen and is made-up of at least one of the select reducing gases set forth in present Claims 7 and 10. Moreover, although the patent teaches an aqueous extraction step, the paragraph bridging columns 2 and 3 indicates that the extraction with water is conducted at a temperature greater than 100° C and at a pH of 8.0 to 11.5, which is not the water treatment aspect of the process of the invention. Clearly, Sasaki fails to suggest the process embodiments of the present invention. Further, because the patent fails to suggest the process embodiments of the invention as claimed, the product resulting from the process of the patent is not the same as that of the present invention claimed in claim 1 which has desirable very low potassium content and a high degree of dissolution in sulfuric acid. Thus, the electrolytic grade of manganese ore is not the grade of electrolytic manganese dioxide taught in the patent. Thus, the patent does not obviate the embodiments of present Claims 31-33 of the present invention.

As to the Kane patent, a process is described therein in which manganese nodules are treated to obtain metal values therefrom. The first step of the process requires the treatment of

the nodules with non-oxygen containing SO_2 as an acidic reducing agent. While SO_2 is a reducing gas which can be used in the process of present Claim 7 and in the first step of the process of Claim 10, the present claims require that the amount of reducing gas used must range from 1.0 to 2.0 the theoretical amount of the reducing agent necessary to reduce the amount of manganese in the ore starting material. On the other hand, Kane only mentions in column 11, lines 55-59 that in a given acidic reduction, comminuted ore in a reaction vessel is fluidized by an upstream flow of SO_2 through the reactor. The amount of SO_2 gas required for fluidization is well beyond the limit of reducing gas relative to manganese ore starting material in the process of the present invention. Accordingly, the reduction process taught by Kane does not result in the product of the present invention. Withdrawal of the patent disclosure is respectfully requested.

As to the Barner et al patent, the same discloses a two stage reduction of manganese nodules with the purpose of removing metal values from the nodules including copper, nickel, cobalt and molybdenum. As such there is no teaching or suggestion of process modifications which result in the treated manganese ore of the invention which provides a high purity product from which electrolytic material can be prepared. There is no teaching or suggestion of a treated manganese ore which has a degree of dissolution in sulfuric acid of at least 98.0 wt %. Accordingly, the product of the invention is not suggested by the patent.

As to the process disclosed in the patent, a first step is required in which manganese nodules are calcined which eliminates some oxygen from MnO_2 thereby resulting in Mn_2O_3. Further high temperature processing occurs at state oxygen partial pressures thereby converting Mn_2O_3 to other more oxygen deficient intermediates of Mn_3O_4 and Mn_5O_8. No such comparable step is used in the present process embodiments. Finally, the reduced oxygen content material is heated in an atmosphere primarily of hydrogen and CO to achieve the intermediate step of

reducing the Cu, Ni and Co values to the metals. (Col 4, line 66). In this regard, the clear teaching of the patent is that **intermediate** manganese oxides, i.e., Mn_2O_3, Mn_3O_4 and Mn_5O_8, are reduced by being subjected to synthesis gas, while other oxides of nickel, cobalt and copper are reduced to the metal state. This is not the reduction step of the present process in Claims 7 and 10 where manganese ore is subjected to reduction to produce a treated ore. Moreover, after the reduction disclosed, the reduced ore is quenched in an ammonia-ammonium carbonate leach liquor which clearly is not the water extraction of the present invention.

From the discussion above it is clear that the embodiments of the invention of Claims 31, 32 and 34 are not suggested by the patent. The treated manganese ore of the invention is a distinctly different material from other such ores because of its very high degree of dissolution in sulfuric acid and its low potassium content. The prior art does not teach or suggest this material. Accordingly, the manganese dioxide material of claim 31 (new Claim 34), derived from the treated manganese ore of Claim 1, is different from other electrolytic grades of MnO_2. The distinctly different treated manganese ore of the invention in turn lends patentable weight to the process embodiments of Claims 32 and 33. Withdrawal of the stated ground of rejection is respectfully requested.

Claim 31 stands rejected based on 35 USC 103(a) as obvious over Takehara, U. S. Patent 5,746,902 or Andersen et al, U.S. Patent 6,214,198 or Riggs, U.S. Patent 4,477,320. This ground of rejection is respectfully traversed.

It is correct that the cited patents disclose the production of manganese dioxide for electrolytic applications by the electrolytic oxidation of high purity manganese sulfate. However, the advantage of the process of the present invention is that a manganese ore is prepared which contains exceptionally low levels of potassium impurity. In this regard, it should be noted that Sasaki discloses in column 1 that electrolytic manganese dioxide which has higher

concentrations of potassium suffers deterioration in capability. What is important in the present invention is that the reduction in the potassium content of manganese ore starting material can be significantly reduced below the potassium concentration levels in conventional manganese materials. This fact, is a materially distinguishing aspect of the treated manganese ore and manganese dioxide electrolytic material of the present invention, and thus it is a novel substance in comparison to conventional manganese oxide materials.

In the present invention, the reduced ore or reduced treated ore is a product which has a very high degree of sulfuric acid dissolution of 98 % by wt or higher and even 99 % by wt or higher. Accordingly, upon production of manganese dioxide by the process of the invention starting with the treated ore of the invention, the amount of slag which is generated can be reduced by a factor of 1/3 to 1/4 which reduces the load on the environment and reduces the concentration of potassium impurity in the electrolytic product manganese dioxide. Accordingly, the rejection based on the cited patents is believed overcome and withdrawal of the same is respectfully requested.

Claims 32 and 33 stand rejected based on 35 USC 103(a) as obvious over El Tawil, U. S. Patent 4,985,216, Sasaki, U.S. Patent 3,667,906, Kane et al, U.S. Patent 3,810,827, Barner et al, U.S. Patent 4,044,094 or Welsh, U. S. Patent 3,375,097 further in view of Bowerman et al, U.S. Patent 4,489,043, Takehara, U. S. Patent 5,746,902, Andersen et al, U.S. Patent 6,214,198, Andersen et al, U.S. Patent 4,948,484 or Riggs, U.S. Patent 4,477,320. This ground of rejection is respectfully traversed.

As stated on the record above, none of the El Tawil, Sasaki, Kane et al, Barner et al, or Welsh patents show or suggest a treated manganese ore which has the specific dissolvability requirement of the present claims. Yet, it is distinctly this material, as discussed above, that provides important advantages when for the preparation of an electrolytic manganese dioxide

material. Moreover, although the Bowerman et al, Takehara, Andersen et al, Andersen et al, and Riggs patents disclose the electrolytic oxidation of manganese sulfate to electrolytic grade manganese oxide, the amount of slag generated in these processes can not be reduced to the low levels achieved in the present invention which uses the claimed treated manganese ore of the invention. Moreover, the prior art processes do not result in the reduced concentration levels of potassium impurity in the desired manganese dioxide product in comparison to the reduced potassium levels achieved in the present invention. Accordingly, the stated ground of rejection is believed obviated and withdrawal of the rejection is respectfully requested.

It is now believed that the application is in proper condition for allowance. Early notice to this effect is earnestly solicited.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.

FD Vastine

Norman F. Oblon
Attorney of Record
Registration No.: 24,618

Frederick D. Vastine, Ph.D.
Registration No.: 27,013

22850

TEL: 703-413-3000
FAX: 703-413-2220

DOCKET NUMBER: 205446US0
SERIAL NUMBER: 09/824,768

MARKED-UP COPY OF AMENDMENT

IN THE CLAIMS

Please amend Claims 3, 4, 7, 9-12, 15, 18, 21-23, 26, 27, 32 and 33 as follows:

--3. (Amended) The treated manganese ore of Claim 1, wherein the ratio of the amount of potassium soluble in sulfuric acid to that of manganese contained in the treated manganese ore [(K/Mn)] by weight is 0.001 or lower.

4. (Amended) The treated manganese ore of Claim 1, which is [one obtained by bringing] prepared by contacting a manganese ore [in contact] with a reducing gas at a temperature ranging [of] from 400 to 790° C.

7. (Amended) A process for producing the treated manganese ore of Claim 1 [for use in producing manganese sulfate therefrom, said treated ore having a degree of manganese dissolution of 98.0 % by weight or higher based on the manganese contained in the treated manganese ore when dissolved in sulfuric acid], which comprises:

[bringing] contacting a manganese ore [into contacted] with a reducing gas that does not contain oxygen and which contains at least one material selected from the group consisting of hydrogen, carbon monoxide, sulfur dioxide, hydrogen sulfide and methane in an amount ranging from 1.0 to 2.0 times the theoretical amount required to reduce the manganese ore at a temperature [of] ranging from 400 to 790° C [to obtain a reduced ore], thereby preparing said treated manganese ore from which manganese sulfate is produced.

9. (Amended) The process for producing a treated manganese ore of Claim 7, wherein the manganese ore is kept in contact with the reducing gas at a temperature [of] ranging from 400

to 790° C for a period [not shorter than the reduction saturation time] necessary to sufficiently reduce the manganese ore with a reducing gas.

10. (Amended) A process for producing the treated manganese ore of Claim 1 [for use in producing manganese sulfate therefrom, said treated ore having a degree of manganese dissolution of 98.0 % by weight or higher based on the manganese contained in the treated manganese ore when dissolved in sulfuric acid], which comprises:

[bringing] contacting a manganese ore [into contacted] with a reducing gas that does not contain oxygen and which contains at least one material selected from the group consisting of hydrogen, carbon monoxide, sulfur dioxide, hydrogen sulfide and methane in an amount ranging from 1.0 to 2.0 times the theoretical amount required to reduce the manganese ore at a temperature [of] ranging from 400 to 790° C [to obtain a reduced ore]; and

immersing the reduced ore obtained [is immersed] in water having a temperature [of] ranging from 70° C to the boiling point thereof as measured at atmospheric pressure, thereby preparing said treated manganese ore from which manganese sulfate is produced.

11. (Amended) The process for producing the treated manganese ore of Claim 10, which further comprises washing [wherein] the reduced ore obtained [is immersed in water having a temperature of from 70° C to the boiling point thereof as measured at atmospheric pressure, and washed].

12. (Amended) The process for producing the treated manganese ore of Claim 10, which further comprises washing and then filtering [wherein] the reduced ore obtained [is immersed in water having a temperature of from 70° C to the boiling point thereof as measured at atmospheric pressure, washed and filtered].--

Please cancel Claims 13 and 14.

--15. (Amended) The process for producing a treated manganese ore of Claim 13,

wherein the reducing gas is diluted [one obtained by diluting said reducing gas] with an inert gas.

18. (Amended) The process for producing a treated manganese ore of Claim 17, [whereintherotarykilnhasacylindricalorprismaticshape] wherein the rotary kiln has a cylindrical or prismatic shape.

21. (Amended) The process for producing a treated manganese ore of Claim 7, [which] wherein the process is conducted continuously.

22. (Amended) The process for producing a treated manganese ore of Claim 8, [which] wherein the process is conducted continuously.

23. (Amended) The process for producing a treated manganese ore of Claim 10, [which] wherein the process is conducted continuously.

26. (Amended) The process for producing a treated manganese ore of Claim 24, wherein the reduced ore [cooling] is [conducted] continuously cooled.

27. (Amended) The process for producing a treated manganese ore of Claim 10, wherein the reduced ore [cooling] is [conducted] continuously cooled.--

Please cancel Claim 31 in favor of new Claim 34 as follows:

Claim 34. (Newly Added)

Please amend Claims 32 and 33 as follows:

--32. (Amended) A process for producing electrolytic manganese dioxide which comprises:

adding sulfuric acid to the treated manganese ore of Claim 1 or 5 to dissolve the ore, [and] thereby [obtain] preparing an aqueous solution of manganese sulfate[,];

purifying the [resultant] aqueous solution of manganese sulfate[,]; and then

subjecting the purified solution to electrolytic oxidation to oxidize the manganese sulfate.

33. (Amended) A process for producing electrolytic manganese dioxide which

comprises:

[obtaining] preparing a treated manganese ore by the process of Claim 7[,];

adding sulfuric acid to the treated manganese ore to dissolve the ore, [and] thereby [obtain] preparing an aqueous solution of manganese sulfate[,];

purifying the [resultant] aqueous solution of manganese sulfate[,]; and then

subjecting the purified solution to electrolytic oxidation to oxidize the manganese sulfate--.